www.ajbrui.org

Afr. J. Biomed. Res. Vol. 20 (January, 2017); 59- 63

Full Length Research Paper

Anaesthetic Indices and Vital Parameters of PPR-Infected West African Dwarf Goats after Epidural Lignocaine Anaesthesia

***Olaifa A. K, Oguntoye C.O and Brown A**

Department of Veterinary Surgery and Reproduction, University of Ibadan, Ibadan, Nigeria

ABSTRACT

Peste des petits ruminants (PPR), is an acute, highly contagious viral disease of sheep and goats associated with high morbidity and mortality. Often times, veterinarians are faced with sick goats presented with co-existing emergency clinical conditions such as foreign body impaction, ruminal tympany, dystocia that require surgical intervention, necessitating the use of anaesthesia. The aim of this study, was to assess and compare the anaesthetic indices and vital parameters of West African Dwarf (WAD) goats naturally infected with PPR before and after epidural anaesthesia with plain lignocaine and also to compare the measured anaesthetic indices with those of healthy goats. Ten goats were used for this study sorted into infected and non - infected goats. The vital parameters of the goats were taken two days prior to the commencement of the experiment. The anaesthetic indices of the animals were measured. The goat's rectal temperature (RT) and respiratory rate (RR) were immediately measured after the epidural injection and subsequently at 15 minute intervals over a 120-minute period using a mercury-in-glass thermometer (˚C) and by visual observation of the thoraco-abdominal excursion respectively. Heart rate was measured in beats/min with the aid of a pericardial stethoscope. The result showed a significant increase in heart rate of PPR infected goats as compared to the healthy gaots, an insignificant increase in respiratory rate and insignificant changes in the rectal temperatures. Time of recumbency and onset of analgesia was significantly reduced in PPR infected goats as compared to the healthy goats. In conclusion, epidural anaesthesia with plain lignocaine in naturally PPR infected WAD goats produced anaesthesia of about one hour with some adverse effects on the vital parameters of the goats and if emergency surgery caudal to the umbilicus is necessary in sick goats, epidural anaesthesia with injection of lignocaine must be used with caution so as not cause unexpected mortality

Keywords; Goats, *Peste des petits ruminants (PPR)*, Lignocaine

*Author for correspondence: *E-mail: akolaifa@yahoo.com; Tel: 08023259842*

Received: January, 2016; Accepted: October, 2017

Abstracted by:
Bioline International, African Journals online (AJOL), Index Copernicus, African Index Medicus (WHO), Excerpta medica (EMBASE), CAB Abstracts, SCOPUS, Global Health Abstracts, Asian Science Index, Index Veterinarius

INTRODUCTION

Peste des petits ruminants (PPR), is an acute, highly contagious disease. According to world organization for animal health (WOAH-OIE), it is notifiable and economically important trans-boundary viral disease of sheep and goats associated with high morbidity and mortality. Clinically, the disease resembles rinderpest in cattle and is characterized by high fever (pyrexia), conjunctivitis, oculo-nasal discharges, necrotizing and erosive stomatitis, diarrhea (Taylor, 1984), and bronchopneumonia followed by either death of the animal or recovery from the disease (Gargadennec and Lalanne, 1942). The causative agent, PPR virus (PPRV) is an enveloped RNA virus belongs to the genus Morbillivirus of the family Paramyxoviridae (subfamily Paramyxovirinae) under the order Mononegavirales (Gibbs et al., 1979) with other members of the genus, which include rinderpest virus (RPV), measles virus (MV), canine distemper virus (CDV), phocine distemper virus (PDV) and dolphin and porpoise morbillivirus (DMV) (Barrett et al., 1993).

In Nigeria, Livestock production makes a major contribution to the Agrarian sector of the economy (Adeleye, 1998). Goat which is referred to as the poor man's cow (Odunsi et al, 2005) has some advantages over the cow in terms of its production. These advantages which have been described by Davendra (1981) also contribute to the potential increase of its production. However, goat production in Nigeria is limited by the incidence of diseases such as Peste des petits ruminants

(PPR) (Omoike, 2006). Indeed, PPR is spreading throughout Africa, south of the Sahara and north of the equator, as well as Asia and the Middle East and is a major factor of food insecurity for populations reliant on the production of small ruminants (Domenech et al, 2006). PPR is an acute, highly contagious viral disease of sheep and goat which is characterized by fever, anorexia, ulcerative necrotic stomatitis, diarrhea, purulent ocular and nasal discharges and respiratory distress which may be associated with coughing, pneumonia and death. (Lefevre and Diallo, 1990). The virus which causes PPR, the peste des petits ruminants virus (PPRV), belongs to the morbillivirus group of the paramyxovirus family of viruses. It is closely related to the rinderpest virus of cattle and buffaloes, the measles virus of humans, the distemper virus of dogs and some wild carnivores, and the morbilliviruses of aquatic mammals. To date, genetic characterization of PPR virus strains has allowed them to be organized into four groups; three from Africa and one from Asia. One of the African groups of PPRV is also found in Asia. The epidemiological significance of these groupings is less clear at present than that of rinderpest virus groupings (FAO, 1999).

Often times, veterinarians are faced with sick goats presented with co-existing emergency clinical conditions such as foreign body impaction, ruminaltympany, dystocia that require surgical intervention, necessitating the use of anaesthesia. These goats may have varying physical status ranging from 3-5 (moderate systemic diseases to major organ dysfunction) based on classification of anaesthetic risk according to the American Society of Anesthetists' classification (Hall et al., 2001). In order to achieve a good outcome in such instances the anaesthetic protocol need to be carefully selected.

A regional anaesthetic technique such as epidural administration of lignocaine is preferred over general anaesthesia in ruminants because they are associated with fewer hazards, they are easier to administer and require minimal equipment. They are suitable for both hospital and field settings, induce awake recumbency, are associated with less complication and have a wide safety margin even in critically sick animals (Taylor, 1991; Fubiniet al., 2004). A goat with PPR will be classified as a class 5 risk animal and because of the prevalence of PPR in this environment may make a good natural model for investigating epidural anaesthesia in a critically ill goat for a rational selection of anaesthetic technique when faced with a sick goat. The aim of this study, therefore, was to assess and compare the anaesthetic indices and vital parameters of West African Dwarf (WAD) goats naturally infected with PPR before and after epidural anesthesia with plain lignocaine and also to compare the measured anaesthetic indices with those of healthy goats.

MATERIALS AND METHODS

Two sets of goats were used for this study. The first set of goats were five West African Dwarf (WAD) goats consisting of 3 non-pregnant, non-lactating does and 2 intact bucks. Their body weights was between the ranges of 8-9kg, purchased from a local market and were selected based on physical examination which revealed the presence of typical clinical signs for PPR. The second set of goats were five clinically healthy West African Dwarf goats obtained from small holder farmers. The healthy goats also consisted of 3 non-pregnant, non-lactating does and 2 intact bucks and had weight range between 8 -10kg.

The healthy goats were housed in pens at a different location from the PPR infected goats. For each location, the goats were housed in separate pens, the females in one pen while the males were in another. They were all fed a maintenance diet which was giant star grass (Cynodonalenifuensis). The diet was supplemented with cereal-based concentrate and dried cassava peelings. Clean water was provided free choice in the pens. The goats were neck tagged and numbered for identification. Competitive enzyme –linked immunosorbent assay (cElisa) was used to confirm diagnosis of PPR (Khan et al, 2007) in the sick goats.

All the goats were treated for latent helminth infection using levamisole (10%), I/M at the dose rate of 10mg/kg bodyweight. They were also placed on multivitamins (Envit®) at 10mg/kg body weight and antibiotics (20% oxytetracycline) against opportunistic/ concurrent bacterial infection.

Anesthetic drugs: Lignocaine hydrochloride (Lignovit-20®, Vital Health Care PVT Ltd, India) was supplied as 20mg per ml of colorless, aqueous solution.

Experimental design: The vital parameters of the goats were taken two days prior to the start of the experiment. In the course of the trials, each of the animals was injected through the epidural route with 2% plain lignocaine hydrochloride at 4mg per kg body weight. The heart rate, respiratory rate, rectal temperature and pulse rate were measured immediately after the epidural puncture and every 15 minutes after epidural blockage over a 120-minute period.

Experimental procedure: The goats were restrained manually on sternal recumbency with the hind limb extended cranially. An area of 5-7cm was clipped generously and prepared surgically for sterile procedure. The lumbosacral junction was located as described by Hall et al., (2001). In order to achieve a relatively painless epidural puncture, a skin bleb was made over the lumbosacral junction with 0.5ml lignocaine solution.

A 21g hypodermic needle was inserted at the lumbosacral junction (using the pelvic protuberance as a landmark to locate the depression) and then advanced into the epidural space. To confirm the presence of the needle in the epidural space, there was a lack of resistance to the injection of air and absence of spinal fluid in the needle cap. The syringe which contained a calculated amount of local anaesthetic agent was attached to the needle and then injected over a period of time. The development of motor and sensory blockade was assessed by the goat's inability to stand on its hind limbs. Serial pinching of the skin of the goat's hind limb, perineum, flank and ventral abdomen caudal to the umbilicus with an artery forceps closed to the first ratchet as used in previous studies (Cruz et al., 1997) was used to determine the onset and extent of analgesia on all or none basis.

Calculations: Time (in min) from epidural injection of anaesthetic solution to paralysis of the goats' hind limbs was recorded as "time of recumbency". Time (in min) to onset of analgesia was measured from the time of epidural injection of anaesthetic solution to loss of reflex response in both hind limbs to pinching with the artery forceps in either of the hind limb, flank or abdominal region just caudal to the umbilicus. The duration of muscle relaxation (in min) was recorded from the time of onset of block to spontaneous movements of the limbs.

Measurements: The goat's rectal temperature (RT) and respiratory rate (RR) were immediately measured after the epidural injection and subsequently at 15 minute intervals over a 120-minute period in the course of the trials. Respiratory rate in breaths/min was determined by visual observation of the thoraco-abdominal excursion. Rectal temperature was determined using a mercury-in-glass thermometer and measured in degrees centigrade (˚C).

Data Analysis: All data was expressed as Means ± SEM. The mean indices of PPR goats and healthy goats were compared using the student-t-test for paired data. The mean values of the measured physiological parameters were compared using the analysis of variance (ANOVA) for repeated measures followed by the Least Significant Difference (LSD) as post-test.

RESULTS

Observations: Following the administration of an epidural anaesthetic solution, neural blockade was consistently achieved in all the experimental goats. The onset of neural blockade was marked by the goat's assumption of a sitting posture with splayed hind limbs. The animal would then be positioned in sternal recumbency with the paralyzed hind limbs placed under the animal's body and its forelimbs under the control of an assistant. Muscle relaxation (motor blockade) in the hindquarters came before analgesia (sensory blockade) in all the goats in this trial. The area of analgesia included the hind limb, perineum, left and right flanks and the ventral abdomen caudal to the umbilicus. This was determined by the goats' response to skin pinching with an artery forceps.

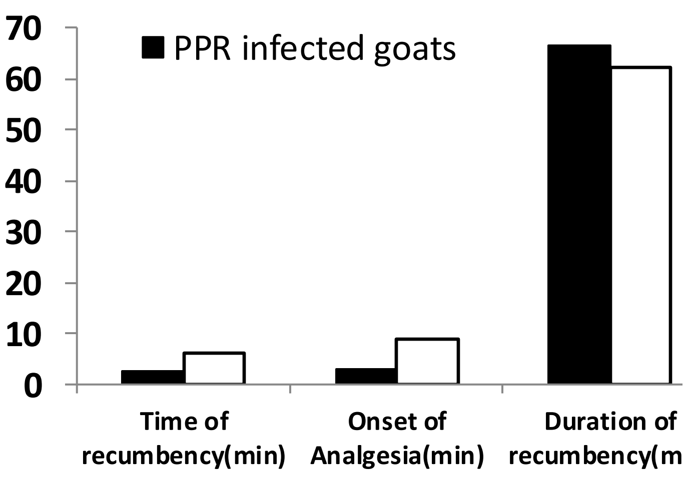

Fig 1:
Anaesthetic indices following epidural anaesthesia with lignocaine in PPR infected goats and healthy goats

During this trial, there was neither excessive cranial spread of the epidurally injected solution which would manifest as respiratory paralysis nor signs of toxicity such as muscle tremors or frank convulsions and cardiac dysfunction. The recovery of the experimental goats from the neural blockade was not complicated by inappetence or any other disability except from a transient ataxic gait.

Anaesthetic indices: The anaesthetic indices of the goats are shown on Figure 1. Mean time to recumbency of the PPR infected goats was 2.5±0.7 minutes. Mean time to onset of analgesia was 3.0±0.8 minutes. Mean duration of recumbency was 66±9.3 minutes.

Mean time to recumbency of the healthy goats was 6.0 ±0.7 minutes. Mean time to onset of analgesia was 8.75 ±7.0 minutes. Mean duration of recumbency was 62.0±11.1 minutes.

Physiological variables

Figure 2 shows the heart rate, respiratory rate, pulse rate and rectal temperature of the PPR infected goats before commencement of the experiments.

Table 1 shows the responses of the goats to the epidural blockade in terms of the heart rate (HR), respiratory rate (RR), pulse rate (PR) and rectal temperature (RT). The mean heart rate of the experimental sick goats ranged between 98.2±12.2 and 106.4±9.9 beats/min. This variable tended to be highest at 75 minutes. The mean rectal temperature ranged between 39.7±0.5 and 40.1±0.3˚C. The mean respiratory rate ranged between 59.2±6.4 and 74.6±19.8 breaths/min. The pulse rate ranged between 89.4±11.3 and 103.4±13.7 beats/min. The responses of the healthy goats in terms of the HR, RR, PR and RT in the healthy goats is shown on Table 1.

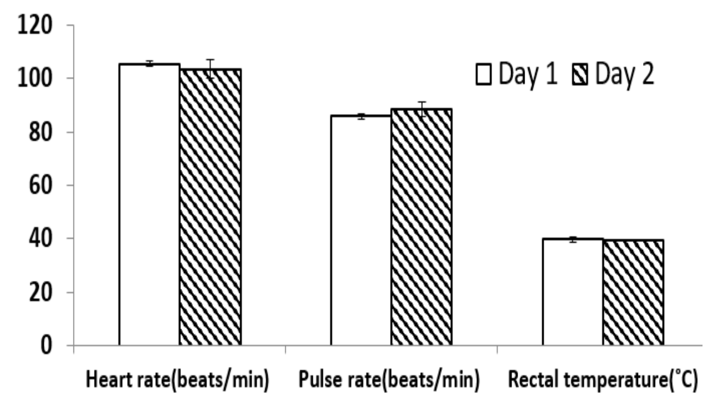

Fig 2:
Heart rate, pulse rate and rectal temperature of PPR infected goats prior to treatment with epidural lignocaine anaesthesia.

Side Effects

The side effects of epidural neural blockade observed in the course of this trial are shown in Table 1. All the treated goats showed signs of periodic premature attempts to stand as well as ataxic gaits in the immediate recovery period. Only a few of the goats exhibited phonation and urination.

Table 1:
Heart rate, respiratory rate and rectal temperature responses of PPRinfected goats (PPR) and healthy goats (control) under epidural lignocaine anaesthesia.

Time interval	HR(beats/min)		RR (breaths/min)		RT(^{0}C)	
(min)	PPR	CONTROL	PPR	CONTROL	PPR	CONTROL
0[a]	98.2±12.2	77.6±6.3	59.6±7.6*	42.0±0.0	40.0±0.3	39.6±0.3
15	101.0±11.4*	73.8±1.0	64.8±7.0	41.2±6.0	39.9±0.3	39.8±0.1
30	103.2±10.4*	79.2±5.0	74.6±9.8	53.8±3.0	39.8±0.5	39.5±0.3
45	104.8±13.0*	73.8±6.0	76.4±10.4	50.0±2.0	39.7±0.5	39.5±0.2
60	105.2±12.1*	75.2±6.0	66.8±12.0	46.8±1.0	39.6±0.5	39.8±0.2
75	106.4±9.9*	75.6±2.0	63.6±14.8	44.8±2.8	39.5±0.4	39.9±0.2
90	104.0±12.6*	76.0±1.0	61.2±14.8	69.2±19.8	39.5±0.4	41.0±1.2

*P<0.05 when compared with PPR infected goats

DISCUSSION

The goats were placed on multivitamin and antibiotics because this is a standard protocol for managing viral infections (Wosu, 1989). Although there is a potential for drug interaction between the antibiotics and anaesthetic drug, no such interaction was noticed in this study.

Although inhalation anaesthesia has the advantage of providing a controllable anaesthetic plane for protracted procedures, physiological support for the patient and fast recovery, its use in a critically sick goat is limited by the need for cumbersome delivery equipment, its suitability for hospital use only and cost. Intravenous anaesthetic technique are cheap, can be used on the field but their use in critically ill animals is not encouraged because they lack physiologic support for the patient and are often times associated with prolonged recovery (Taylor, 1991). Epidural anaesthesia like other regional anaesthetic technique, when properly performed does not result in blood levels of local analgesics that are sufficient in causing systemic effects (Covino, 1985). In this study, epidural anaesthesia with the use of plain lignocaineproduce a significant change in physiological parameters on the treated goats compared to untreated animals.The heart rate of the treated goats were significantly higher compared to control at the time interval of 15,30, 45, 60, 75 and 90minutes while the respiratory rate was also higher compared to control although not statistically significant. There was no significant change in the rectal temperature in treated and untreated goats.Thoracic epidural anesthesia with local anesthetics (eg, lidocaine) can produce a selective segmental blockade of the cardiac sympathetic innervations (T1-T5) (Liu *et al.*, 1995).In an animal study, epidural anaesthesia showed a beneficial effect with a significantly slower heart rate, decreased mean pulmonary artery pressure and central venous pressure, and significantly higher stroke volume index and oxygenation (Jahn*et al.*, 2001). The higher heart rate and respiratory rate observed in the treated goats could have been the disease condition of the goats (PPR infected) and not really the epidural administration.Pyrexia, necrotic stomatitis,catarrhal inflammation of the ocular and nasalmucosae, enteritis and pneumonia are clinical signsfollowed by death or recovery fromPest Petites Ruminante(Nisbet*et al.*, 2007).An association of increased heart rate and respiratory rate with temperature is likely to be caused by a mixture of vasodilatation causing apparent hypovolaemia and increased metabolic rate due to pyrexia. (Davies and Maconochie, 2009)

The time to onset of analgesia in the PPR infected goats (3.6±0.8 minutes) was significantly shorter (P<0.05) than that of the control (6.0±0.7) healthy goats although this time to onset of analgesia in the PPR infected goats (3.6±0.8 minutes) compared well to those of healthy goats of 3.5±0.8minutes reported by Umar and Gapsiso (2008).

The shorter duration of recumbency obtained for the PPR infected goats than the control is noteworthy. Local anaesthetic agents in the small quantity needed for epidural anaesthesia is usually not associated with any systemic effect. (Taylor, 1991). Nevertheless, the durations of recumbency of 65.3± 9.3 and 62.0 ± 11.1 obtained in this study for the PPR infected and healthy goatsrespectively differs butinsignificantly (P<0.05) from the duration of action of 60 minutes with lignocaine without adrenaline (plain lignocaine) in healthy animals (Hall *et al.*, 2001). In conclusion, epidural anaesthesia with plain lignocaine in naturally PPR infected WAD goats produced anaesthesia of about one hour with some adverse effects on the vital parameters of the goats and if emergency surgery caudal to the umbilicus is necessary in sick goats, epidural anaesthesia with injection of lignocaine must be used with caution so as not cause unexpected mortality. .

REFERENCES

Jahn UR., Waurick R., Van Aken H., Hinder F., Booke M., Bone HG.et al., (2001). Thoracic but not lumbar, epidural anaesthesia improves cardiopulmonary function in ovine pulmonary embolism. *AnaesthAnalg*. 93; 1460-1465.

Nisbet, C., Yarim, G.F., Gumusova, S.O. and Yazici, Z. (2007) Investigation of the antioxidativemetabolism in sheep with *pestedespetits*ruminants. *Acta. Vet. (Beograd)*. **57**, 351-356.

Liu S, Carpenter RL, Neal JM. (1995). Epidural anesthesia and analgesia.*Anesthesiology*; 82:1474–1506.

Davies P., Maconochie I. (2009). The relationship between body temperature, heart rate and respiratory rate in children*Emerg Med J*;
26:641–643

Odunsi, A. A, Togun, V. A. and Oladunjoye, I. O. (2005). Introduction to Animal Production and Processing. Oluseyi Press Limited, Nigeria.

Omoike A (2006). Prevalence of diseases among sheep and goats in Edo State Nigeria. J. Agric. Soc. Res. 6:23-31.

Pollot, G., Wilson, R.T. (2009) Sheep and Goats for diverse products and profits. FAO diversification booklet, 9, pp 42.

Adeloye, A.A. (1998). The Nigerian Small Ruminant Species. Cooperate Office, Maximum, Ilorin, Nigeria. Pp 7-8.

Domenech, J., Lubroth, J., Eddi, C., Martin, V., Roger, F. (2006) Regional and international approaches on prevention and control of animal transboundary and emerging diseases. Ann N.Y. Acad. Sd. 1081, 90- 107.

Lefevre, P.C. and Diallo, A. (1990) Peste des petits ruminants. Rev. Sci. Tech, 9: 935-981.

Hall, L.W., Clarke, K.W., Trim, C.M. (2001) Principles of Sedation, analgesia and premedication. In: *Veterinary Anaesthesia, 10th edition,* Elsevier, Oxford. pp 75-112.

Taylor, P.M., (1991) 'Anaesthesia in sheep and goats', In Practice 13, 31–36.

Boesch, J.M., and Campoy L. (2004) Sedation, General Anesthesia, and Analgesia in Farm animal surgery. Fubini, S.L., Duchame, N.G.(editors) St Louis, Harcourt Health Sciences Pp 60-80.

Khan, H.A., Siddique, M., Arshad, M.J., Khan, Q.M., Rehman, S.U. (2007) Sero-prevalence of peste des petits ruminants (PPR) virus in sheep and goats in Punjab province of Pakistan. *Pakistan Veterinary Journal,* **27**, 109–112.

Cruz, M., Luna, S.P.L., Clark, R.M.O, Massone, F., Castro, G.B. (1997). Epidural anaesthesia using lignocaine, bupivacaine or a mixture of lignocaine and bupivacaine in dogs. J. Vet. Anaesth. 24(1): 30-32.

Umar, M.A., and Gapsiso, R.H. (2009) Comparison of xylazine, lignocaine and combination of xylazine and lignocaine for epidural anaesthesia in goats. Nigerian Veterinary Journal 29(2): 15-19.

Barrett T, Amarel-Doel C, Kitching RP, Gusev A. (1993) Use of the polymerase chain reaction in differentiating rinderpest field virus and vaccine virus in the same animals. Rev Sci Tech.;12(3):865–872.

Gibbs EP, Taylor WP, Lawman MJ, Bryant J. (1979) Classification of peste des petits ruminants virus as the fourth member of the genus *Morbillivirus.* Intervirology.;11(5):268–274.

Gargadennec L, Lalanne A. (1942) La peste des petits ruminants. Bull Serve ZootechEpizootAfrOccid Fr.;5:16–21.

Taylor WP. (1984) The distribution and epidemiology of peste des petits ruminants in the sultanate of oman. Vet Microbiol.;22:341–352.